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FOREST PEST MANAGEMENT REPORT

Appraisal of Current and Potential Injury by the Saratoga Spittlebug on the Nicolet National Forest - 1981

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Abstract

A Saratoga spittlebug appraisal survey was conducted in red pine plantations in the susceptible size range of 2 to 14 feet on the Nicolet National Forest during September, 1981. A relative risk rating of high, moderate, or low was assigned to all of the 162 plantations examined. Spittlebug feeding scar counts, alternate host abundance, the presence of spittlebug caused flagging, stand vigor, and stand closure were factors considered in assigning risk. Seven plantations were found to be damaged beyond recovery and an additional 20 plantations are severely threatened. Estimated current losses total $140,000 for the 7 damaged plantations and an additional $265,000 could be lost if the 20 severely threatened stands become similarly damaged. Management alternatives are discussed.

Introduction

Foresters on the Nicolet National Forest reported that Saratoga spittlebug, Aphrophora saratogensis (Fitch), population buildups may be the cause of recently detected damage in young red pine, Pinus resinosa Ait., plantations. There was also concern that other red pine plantations may have spittlebug populations, although damage had not yet been detected.

The Saratoga spittlebug is a small tan insect with a white arrow-shaped marking on its head and upper body. The preferred host for adult spittlebug feeding is red pine, but the insect will also feed on jack pine, Pinus banksiana Lamb, Scots pine, Pinus sylvestris L., and eastern white pine, Pinus strobus L. Adults feed by piercing the bark of branches and feeding on the sap. These puncture wounds develop into necrotic areas which can restrict nutrient flow in the branches. One or more years of heavy feeding can result in flagging, top kill, stem deformity and tree death.

Alternate hosts plants are required to complete the nymphal stage of the Saratoga spittlebug life cycle. Nymphs hatch in early May from eggs laid the previous summer on the pine buds, drop to the ground, and seek out alternate hosts to feed on. Sweetfern, Comptonia peregrina (L.) Coult, brambles, Rubus spp., and willow, Salix spp., are important alternate hosts, and a variety of herbaceous species are also used.

In response to the concern expressed by foresters on the Nicolet National Forest, Forest Pest Management personnel, assisted extensively by two field crews from Toumey Nursery in Watersmeet, Michigan, conducted a Saratoga spittlebug survey in 3 to 14 year old red pine plantations. The survey was conducted from August 27, 1981 to September 24, 1981.

Objective

The objective of this survey was to identify red pine plantations on the Nicolet National Forest that had been seriously attacked or had a high potential for attack by the Saratoga spittlebug. This information would then be used in determining future spittlebug management on the forest.

Methods

Forest personnel provided Forest Pest Management with computer sorted lists and compartment maps of red pine plantations established from 1963 to 1978. Plantations established before 1967 were eliminated from the field survey on the assumption that the majority of the trees would be over 15 feet (4.6 meters) tall. Field crews located 171 red pine plantations, totaling 4,233 acres (1,713 hectares). If the trees were in the susceptible size range of 2-15 feet (0.6 m - 4.6 m), and the plantation was larger than one acre (0.4 hectares) in size, field data were collected.

Using compartment maps, survey lines were plotted to obtain a representative sample of each plantation. Samples were collected along survey lines at intervals of 2-6 chains, (40-120 m) keeping at least 1 chain (20 m) from the plantation edge. The number of samples collected was determined by the plantation acreage (Table 1) with a minimum of 10 samples per plantation.

Table 1.--Intensity of branch sampling for scar counts in red pine plantations, Nicolet National Forest, 1981.

Plantation Size in acres	Minimum Number of samples
0-10	10
11-20	15
21-80	20
81-160	30
161-240	40
241-320	50
321 and up	60 (+1 for each additional 8 acres)

A 4 inch (10 cm) length of last year's (1980) growth was cut from a branch in the upper crown of each sample tree. The bark was removed and feeding scars on the wood were counted. This information, along with observations on flagging, abundance and variety of alternate hosts, stand closure and tree vigor were recorded on the field data sheets and used to risk rate each plantation. Risk rating factors have been generalized into risk categories in Table 2.

Table 2.--Relative risk rating factors considered in evaluating red pine plantations for Saratoga spittlebug, Nicolet National Forest 1981.

Risk Category	1980 Feeding Scar Counts	Crooking & Flagging	Alternate Hosts	Stand Closure	Stand Vigor
Low	1 - 5	None	Few	Closed	Good
Moderate	6 - 10	Some	Moderate	Open	Fair
High	11 +	Heavy	Abundant	Open	Poor

Actual risk category assignments were determined from the overall impression of stand condition and not always from strict adherance to the risk rating factor categories. Greater weight was placed on the 1980 feeding scar counts and the presence of crooking and flagging, as these factors indicate actual rather than potential spittlebug populations.

Results

Saratoga spittlebug activity was found throughout the Nicolet National Forest. The survey crews located 171 plantations and completed examinations on 162 of these stands totaling 4088 acres (1654 hectares). The assigned risk ratings for these stands are listed in Appendix Tables 1-4. High risk was assigned to 26 stands, (410 hectares), moderate risk to 42 stands, (352 hectares), and a low risk rating to 94 stands, (892 hectares). Of the 26 high risk stands, 7 have been damaged beyond recovery. Moderate and high risk stands accounted for 42 percent of the total number of stands examined, but varied between districts from 19 percent to 52 percent.

The majority of the moderate and high risk stands are on the Lakewood District (Table 3). The Eagle River District also has a high percentage of moderate and high risk stands. However, only 19 stands were examined on the Eagle River District in comparison to 91 stands examined on the Lakewood District. Although alternate hosts were abundant throughout the Nicolet National Forest, sweetfern was present in large amounts only in the stands examined on the Lakewood and Eagle River Districts.

TABLE 3--SARATOGA SPITTLEBUG RISK RATING SUMMARY, BY DISTRICT, NICOLET NATIONAL FOREST - SEPTEMBER, 1981

DISTRICTS	STANDS INSPECTED		LOW RISK STANDS		MOD RISK STANDS		HIGH RISK STANDS	
	NO.	ACRES	NO.	ACRES	NO.	ACRES	NO.	ACRES
Lakewood	91	2135	44	817	30	536	17	782
Florence	25	709	18	505	4	102	3	102
Laona	27	877	22	731	3	106	2	40
Eagle River	19	367	10	151	5	126	4	90
All Districts	162	4088	94	2204	42	870	26	1014
Percent	100	100	58	54	26	21	16	25

Discussion and Recommendations

Risk could have been estimated solely on the basis of the relative abundance of alternate hosts. However, if this criterion alone was used to assess risk, nearly all of the stands examined would fall into the high risk category. Since scar counts were being made to assess previous spittlebug feeding, this information, as well as tree size, tree vigor, stocking and the presence of flagging, was also used in determining risk classification. This was done because observations on this and other Forests have shown that many stands considered high risk, only on the basis of alternate host abundance, have never developed spittlebug problems. By considering several factors, we reduced the number of stands where the need for management was apparently more urgent. Many stands that would have been rated high risk solely on the basis of alternate hosts showed no evidence of previous spittlebug feeding, and were thus rated low or moderate risk instead. Conversely, some stands that would have been categorized as low or moderate risk based on alternate host abundance, have been given higher ratings due to evidence of considerable previous spittlebug feeding.

The assigned risk ratings (Appendix Tables 1-4) then, are our best estimates based on the available information at that point in time. Since these ratings are somewhat subjective, it is possible that stands rated in the low category may actually deserve a higher risk rating and corresponding frequency of inspection. Also, these ratings may change with time. As alternate hosts abundance changes with stand succession and as insect populations fluctuate or migrate, the threat to a given stand may increase or decrease. These changes in conditions often occur quite rapidly, an important reason for agressive surveillance during the period before stand closure.

There was little heavy feeding found on the branch samples taken from last year's (1980) growth. Only seven stands had average scar counts of 20 or more per 4 inch (10 cm) sample. The field notes, however, indicate that flagging is found in many stands where scar counts on the 1980 growth fall into the low or moderate risk category. It would appear that, in general, Saratoga spittlebug populations on the Forest have been larger in past years than at the present time.

In several of the plantations surveyed, the red pine is growing in competition with other species including aspen, cherry, jack pine and spruce. Although competition may accelerate crown closure, it more often produces only partial closure, thus allowing alternate hosts to continue to grow. At the same time, this competition can reduce red pine growth and vigor, and prolong the length of time in which the red pine remain in the size class most susceptible to Saratoga spittlebug damage.

Alternate hosts were abundant in the majority of the plantations in which crown closure had not occurred. Sweetfern was found in most of the plantations on the Lakewood and Eagle River Districts but in only a few of those on the Florence and Laona Districts. The high risk plantations had an abundance of either sweetfern, brambles or a combination of the two. The abundance of alternate host material on most of the plantations surveyed could be a factor in the size and severity of future spittlebug outbreaks.

There are a variety of alternatives available for managing the Saratoga spittlebug on the Nicolet National Forest. However, anything less than herbicide treatment of the alternate host material on those stands identified as high and moderate risk is, at best, a gamble. The management alternatives are:

DO NOTHING --

To do nothing to an infestation, and be prepared to accept the losses, is a bonafide approach. This is particularly true where, economically or geographically, benefit-cost considerations dictate such action. Sometimes however, the "do nothing" approach is opted by default, rather than being consciously chosen. This often happens with the spittlebug, where damage is more subtle and early detection requires careful observation. By the time spittlebug damage becomes apparent to casual observation, it is often too late to apply any practical management alternatives. The results of this survey evidence the fact that the spittlebug can cause severe damage. Twenty plantations totaling 664 acres (269 hectares) were found to be severely threatened while seven other plantations totaling 350 acres (142 hectares) have suffered irreparable damage. These plantations will have to be cleared and replanted. In the past, such regeneration costs might not have been a severe impact on the budget, but currently, with drastic cutbacks in government spending commonplace, the cost of re-establishment may have serious budgetary impacts.

A simple economic analysis of current and possible future losses is quite revealing. For the purposes of this analysis, we have assumed:

Initial loss = $100 per acre -- this is an estimated average which includes site preparation, planting stock and labor, and overhead costs for plantations established 7 to 14 years ago.

Reestablishment = $300 per acre -- this includes the same costs at at current rates.

Present losses for the seven plantations damaged beyond recovery would include:

Initial loss --	350 acres @ $100 per acre =	$ 35,000
Reestablishment --	350 acres @ $300 per acre =	105,000
		$140,000

If the severely threatened plantations were lost in the next year or two, approximate losses would include:

Initial loss --	664 acres @ $100 per acre =	$ 66,400
Reestablishment --	664 acres @ $300 per acre =	199,200
		$265,600

Thus, total losses might ultimately reach $405,600 if the severely threatened plantations are damaged further. These estimates are conservative and do not include annual growth loss due to spittlebug feeding in less severely affected red pine plantations. Also, these estimates do not take into consideration the 22 to 26 years of lost growth due to tree mortality. Considering these factors, the "do nothing" approach is not a recommended management alternative on this Forest.

INCREASE SURVEILLANCE --

Such losses can be significantly reduced, however, through surveillance commensurate with stand risk. As the risk rating for a given stand increases, so should the frequency of inspection. By properly monitoring stands, potentially damaging populations can be detected early. Early detection provides the resource manager with more reaction time and a greater number of management options. Your first option may be to maintain surveillance and wait to see what happens. Populations might collapse and never reach severely damaging levels. If this happens, your only costs have been the surveillance labor.

HERBICIDE TREATMENTS --

If populations in a particular plantation appear to be building and detection was timely, an option might be to use herbicides. This approach provides double benefits in that it removes the alternate hosts necessary for spittlebug development, and at the same time, removes much of the competing vegetation, thus enhancing red pine growth. This in turn, leads to faster stand closure and elimination of the spittlebug problem altogether.

USE INSECTICIDES --

In cases where detection is not timely, where damage is severe, and where spittlebug populations are high, often the only option is chemical control of the insect. Before this is attempted, however, an evaluation should be made to determine that sufficient stock of suitable quality would remain to obtain the desired stocking level assuming no further spittlebug damage occurs. If the stocking survey results are favorable, then a biological evaluation with benefit/cost analysis and environmental assessment should be performed to justify a control project.

PRE-PLANTING SURVEYS --

Previous discussion deals with handling or treating spittlebug problems in previously established red pine plantations. A far better, and less costly, approach is to evaluate potential sites before establishing red pine plantations. A method of risk rating areas for red pine plantations developed by Wilson (1971) is based on a simple ocular estimate of the percent of sweetfern and the percent of other alternate hosts. These estimates are plotted against a spittlebug risk-rating graph to determine potential injury levels.

Unless site preparation methods remove the alternate hosts, red pine should not be planted on high risk areas. You should also recognize that additional herbicide treatments or chemical suppression of the spittlebug may be necessary on those high risk sites you choose to plant in red pine. New red pine plantings on areas where potential injury levels are moderate could be established at closer spacings to encourage early crown closure.

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References

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Appendix Table 1.--Stand risk ratings for the Lakewood Ranger District, Saratoga spittlebug survey, Nicolet National Forest - 1981.

Compartment	Stand	Risk*	Acres	Mean Tree Height	Mean Scar Count	Alt. Hosts	Comments
6	11	H	12	7	1	H	
9	13	H	42	>14	>30	H	Replant
27	3	H	21	10	2	H	Probable Replant
27	4	H	150	9	13	H	Probable Replant
35	30	H	9	9	9	H	Flagging, Monitor
36	6	H	3	6	10	H	
65	7	H	61	7	44	H	Probable Replant
85	1	H	20	8	15	H	Monitor
95	9	H	33	3	6	H	Monitor
150	35	H	26	8	20	H	Reexamine Soon
152	19	H	26	11	34	H	Reexamine Soon
157	29	H	103	9	7	H	Monitor
158	2	H	12	10	12	L-M	Monitor
158	3	H	14	11	24	L-M	
159	9	H	214	7	16	H	Monitor
161	11	H	17	6	10	H	Needs Release/Monitor
183	8	H	19	11	18	H	Probable Replant
3	30	M	7	6	1	H	
3	31	M	8	8	<1	H	
4	19	M	21	5	3	H	
4	25	M	36	7	2	H	
5	49	M	7	6	1	H	
6	4	M	13	7	2	M	
6	5	M	4	9	8	M	
7	6	M	7	10	4	H	
8	3	M	24	>14	2	-	
8	4	M	14	9	2	M	
9	37	M	14	9	6	H	Monitor
11	9	M	18	6	2	H	
14	4	M	16	4	1	H	
27	7	M	13	8	2	M	
44	14	M	8	>14	7	H	Monitor
61	2	M	7	11	9	M	
71	11	M	8	12	4	H	
89	34	M	37	4	4	M-H	
89	39	M	21	4	8	M	Monitor
90	26	M	32	3	8	H	Monitor
96	2	M	39	3	4	H	
145	25	M	2	10	5	M	
151	25	M	47	5	4	H	
153	2	M	5	11	6	M	
153	26	M	6	12	3	M	Aspen Overstory
157	28	M	51	5	4	H	
157	40	M	6	11	6	H	
185	13	M	23	6	5	H	
186	11	M	35	9	5	H	

Appendix Table 1.--Continued

3	1	L	3	>14	-	-	
5	23	L	21	>14	-	-	Good Closure
5	43	L	9	>14	-	-	Good Closure
6	12	L	24	<3	-	-	
7	2	L	35	>14	-	-	
8	2	L	8	>14	-	-	
8	6	L	16	>14	-	-	
8	8	L	10	>14	-	H	
8	12	L	14	>14	-	-	
9	21	L	12	>14	-	H	
27	8	L	7	>14	-	-	
29	14	L	52	>14	-	-	Good Closure
31	8	L	3	>14	-	-	
31	9	L	9	>14	-	-	Good Closure
31	10	L	23	>14	-	-	
31	14	L	8	>14	-	-	Good Closure
36	3	L	15	6	1	H	
37	29	L	10	>14	-	-	
52	7	L	32	>14	-	-	Good Closure
61	4	L	4	>14	-	M	
71	4	L	25	>14	-	-	
94	5	L	51	<3	-	H	
94	6	L	31	<3	-	H	
94	7	L	14	<3	-	H	
95	11	L	7	3	1	M	
95	12	L	32	<3	-	H	
96	3	L	26	<3	-	-	
103	5	L	34	<3	-	-	
103	20	L	75	>14	-	-	Good Closure
104	3	L	29	4	<1	H	
138	11	L	2	>14	-	M	
150	19	L	13	>14	-	-	
153	25	L	14	8	<1	M	Aspen Overstory
157	34	L	10	>14	-	-	
157	35	L	27	>14	-	-	
158	11	L	7	>14	-	-	Good Closure
160	5	L	17	>14	-	-	Good Closure
161	22	L	28	5	1	M	
162	3	L	2	11	3	M	
162	13	L	11	>14	-	-	
173	12	L	6	>14	-	-	Good Closure
173	33	L	20	>14	-	-	Good Closure
182	14	L	3	>14	-	-	
89	36	NS	41	<3	-	-	Apparent Failure
151	10	NS	20	-	-	-	
157	27	NS	38	-	-	-	

*L - Low
M - Moderate
H - High
NS - Not surveyed

Appendix Table 2.--Stand risk ratings for the Florence Ranger District, Saratoga spittlebug survey, Nicolet National Forest - 1981.

Compartment	Stand	Risk*	Acres	Mean Tree Height	Mean Scar Count	Alt. Hosts	Comments
47	14	H	22	7	<1	L-M	
68	19	H	4	7	24	M	
100	3	H	76	10	9	H	West half a replant
16	1	M	6	11	8	L	
68	16	M	67	7	3	M	
114	20	M	21	6	5	M	
171	22	M	8	10	4	L	Monitor-some flags
18	27	L	10	6	3	M	
19	25	L	67	6	1	M	
36	9	L	36	5	1	M	
36	25	L	27	4	<1	M	
39	9	L	13	>14	-	-	Good Closure
71	11	L	33	6	<1	L	
71	12	L	23	5	<1	M	
78	3	L	9	10	<1	M	
78	5	L	101	>14	-	-	
100	11	L	5	>14	-	-	
100	15	L	12	>14	-	-	
116	3	L	11	10	<1	L	
120	13	L	43	3	<1	L-M	
120	17	L	27	7	<1	H	
120	25	L	3	9	3	M	
156	10	L	13	10	<1	L	
173	7	L	18	>14	-	-	
175	1	L	54	10	2	L	
15	5	NS	1	-	-	-	
18	18	NS	12	-	-	-	
19	22	NS	8	-	-	-	
116	9	NS	1	-	-	-	

*L - Low
M - Moderate
H - High
NS - Not surveyed

Appendix Table 3.-- Stand risk ratings for the Laona Ranger District, Saratoga spittlebug survey, Nicolet National Forest - 1981.

Compartment	Stand	Risk*	Acres	Mean Tree Height	Mean Scar Count	Alt. Hosts	Comments
3	25	H	19	>14	-	-	Reexamine Soon
103	12	H	21	>14	>30	M	Probable Replant
104	1	M	42	5	2	M	
104	28	M	55	4	5	M	
108	16	M	9	10	4	M	
39	10	L	8	9	2	L	
49	16	L	51	<3	-	L	
52	21	L	47	4	0	L	
52	22	L	28	<3	-	L	
99	8	L	52	>14	-	-	Good Closure
104	10	L	56	5	<1	M	
104	13	L	7	>14	-	-	
105	2	L	13	>14	-	-	Good Closure
107	1	L	25	<3	-	L	
108	14	L	27	>14	-	-	Good Closure
108	15	L	32	>14	-	-	Good Closure
150	4	L	20	>14	-	-	Good Closure
150	10	L	36	>14	-	-	Good Closure
164	1	L	6	7	0	H	
164	2	L	18	8	2	H	
167	3	L	7	>14	-	-	Good Closure
167	6	L	9	>14	-	-	Good Closure
175	11	L	63	>14	-	L	
238	37	L	70	<3	0	L	
239	3	L	24	4	<1	L	
239	15	L	66	4	<1	L	
256	11	L	66	7	1	L-M	
13	13	NS	20	-	-	-	

*L - Low
M - Moderate
H - High
NS - Not surveyed

Appendix Table 4.-- Stand risk ratings for the Eagle River Ranger District, Saratoga spittlebug survey, Nicolet National Forest - 1981.

Compartment	Stand	Risk*	Acres	Mean Tree Height	Mean Scar Count	Alt. Hosts	Comments
3	15	H	14	8	13	M	
129	17	H	37	7	3	H	
183	16	H	3	7	9	H	
183	22	H	36	7	31	H	Reexamine Soon
45	5	M	46	7	3	M	
116	1	M	45	4	3	H	
116	11	M	6	4	4	H	Monitor
198	22	M	10	9	12	M	
209	14	M	19	7	3	H	
35	2	L	16	6	0	L	
45	12	L	41	6	2	L	
79	29	L	25	5	<1	H	
91	5	L	14	>14	-	-	Good Closure
172	12	L	4	4	<1	L	
173	12	L	26	<3	-	L	
173	14	L	4	4	1	L	
182	13	L	-	6	2	L	
192	28	L	-	5	1	M	
198	18	L	21	9	1	M	
121	13	NS	4	-	-	-	

*L - Low
M - Moderate
H - High
NS - Not surveyed